One Step Forward Toward Understanding Lab Animal Behaviors Using Digital Video Technologies

Liang, Yiqing*, Kobla, Vikrant, Bai, Xuesheng, Zhang, Yi
Clever Sys. Inc., Reston, VA, USA

Observations of lab animal behaviors have been historically used to understand brain functions, learning and memory, depression, and other neurological disorders, and have found even more applications in research in post-genomic era. Many behavior experiments have been invented, designed, and put in practical use. However, questions exist as whether those experiments have been able to really help people understand the meaning of the behaviors, and whether those observations bear intrinsic meaning for research.

Lab animal behaviors research has widely employed video data format for observation and acquiring data. Video data has several unique features, including huge amount of data and the uninterruptible information transmission, repetitive data from frame to frame, the linear sequential nature of media data. These features have presented both challenging tasks and opportunities for obtaining good understanding of its content.

Human observation of lab animal behaviors via video is a slow and labor-intensive task, and thus expensive. Human observation is subjective, and often suffers from errors because human gets tired and distracted after long hours' watching video. Most of all, we are not sure if our observations and experiments have revealed the intrinsic meaning of lab animal behavior by observation. Therefore, behavior analysis has formed an obstacle in biological and medical research.

Exploring and understanding the huge amount of video behavior data is definitely a complex data-mining task, involving heavy sequence analysis and pattern recognition, and computer vision techniques.

However, digital video technologies come to the rescue. Based on the features of video, we have invented the idea of analyzed video of animal behaviors through various algorithms with computer vision, pattern recognition, artificial intelligence and machine learning. We have designed a suite of products that can automatically, precisely, quickly, and objectively understand lab animal home cage behaviors, or animal "life style". This "life style" bears full semantic meaning of animal unconstrained daily activities, presenting opportunities for scientist to understand animal health through behaviors. We also have designed a suite of algorithms that can extract significant behavior parameters that could not be obtained before, such as stretch-and-attend, head-dipping, turning ratio, and etc. which could been more revealing and shed more lights on the intrinsic of behaviors related to learning and memory, anxiety, depression, Parkinson diseases, epilepsy, and social interactions.

We expect to extend the technologies for automated lab animal behavior analysis for human behavior analysis that could find applications in assisting Parkinson disease's patients and Alzheimer disease's patients daily life, in their rehabilitation, and in better diagnosis of epilepsy patients.